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D. J. Jordon
University of Nebraska-Lincoln

Terry J. Klopfenstein
University of Nebraska-Lincoln, tklopfenstein1@unl.edu

Mark Klemesrud
University of Nebraska-Lincoln

Comparative Calf Grazing of Corn and Soybean Residues

D. J. Jordon
Terry Klopfenstein
Mark Klemesrud[1]

Soybean residues are higher in crude protein, lower in digestible energy and have only one-third the carrying capacity of corn residues.

Summary

A grazing trial was conducted in the winter of 1996-97 to compare the feeding value of soybean stubble to that of cornstalks. Irrigated bean residues were stocked at 0.5 animals/acre, while irrigated corn residues were stocked at 1.2 animals/acre. Calves grazing cornstalks gained (0.17 lb/day) faster (P = .003) than calves consuming soybean stubble (-0.03 lb/day). In addition, calves grazing cornstalks remained in fields 14 days longer. Diet samples were collected on both corn and soybean residues. Ruminally fistulated steer calves grazing bean stubble consumed diets high in crude protein (12-25%), but low in organic matter digestibility (40-46%). Calves grazing cornstalks consumed diets from 5-6% crude protein and 60-65% digestibility.

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Introduction

While cornstalks are widely utilized by cow/calf producers for winter grazing, many acres of bean residue are either not utilized or utilized only as a consequence of previously existing fence surrounding both corn and bean fields. Cattle are allowed to run on bean stubble simply because it is easier for the producer to allow animals access to a bean field rather than fence it from an adjacent corn field. Observations suggest cattle spend considerable time foraging in bean residue; however, no studies have been conducted to determine the diet quality the animals select. Although previous study has shown calves grazing corn residue gained faster than calves grazing a combination of soybean stubble and cornstalks (1997 Nebraska Beef Cattle Report, pp. 26-27), it is unclear how long calves may be wintered on solely bean residue (2 acres/animal) without drastically impacting performance.

The objectives of the present trial were to evaluate the feeding value of soybean residue compared to corn residue, to estimate carrying capacity of bean residues and to determine the diet quality selected by calves grazing winter corn and bean residues.

Procedure

From November 22, 1996 through January 31, 1997, 123 weaned, crossbred steer calves (540 lb) were used in a randomized complete block design to compare the feeding value of soybean and corn residue. Calves were assigned randomly to one of 12 irrigated residue fields. Eight corn fields contained 16, 15, 11, 11, 11, 11, 8 and 7 head. Four bean fields contained 12, 9, 6 and 6 head. Head counts in corn fields were based on acreage and an irrigated corn residue stocking rate of 1.2 hd/acre. Residual corn estimations were determined in corn fields. Estimations were determined by collecting whole and partial ears from an area 250 x 2.5 ft. Head counts in bean fields were based on acreage and an irrigated bean residue stocking rate of 0.5 hd/acre, based on the amount of available pod DM in bean fields (1997 Nebraska Beef Cattle Report, pp. 26-27).

Throughout the grazing period, calf weights from one corn field and one bean field were monitored to determine when the weight of cattle grazing bean residues began deviating from cattle grazing cornstalks. Individual weights were taken three times weekly and plotted. Weights were taken using two portable automatic scales: one set up in the corn field; the other was placed in the bean field.

Animal performance was measured in terms of ADG. All initial cattle weights and final weights on cattle grazing corn residues were based on the average of two consecutive day weights following three days of limit feeding at 2% of body weight. Final weights for the cattle grazing bean residues were simply a one day weight upon removal from fields. Based on weights obtained from the automatic scales, cattle on the bean residue were removed two weeks earlier than calves grazing cornstalks.

Diet samples were collected using four ruminally fistulated steer calves (525 lb). Two of the four were maintained on a corn field; the remaining two calves were maintained on a bean field. Calves were allowed a one week adaptation to their respective fields prior to the first collection. In addition, all four calves were supplemented with 6 lb/hd (DM basis) of wet corn gluten feed each day. Supplementation was necessary in order to maintain condition and animal health of the calves due to the cold conditions during ruminal evacuations. Diet samples were collected following complete rumen evacuations. Calves were allowed a 30 minute grazing period, sampled and rumen contents replaced. While an attempt was made to collect diet samples twice weekly, weather often dictated when samples were taken. Diet samples were freeze dried, ground and analyzed for CP and IVOMD.

All calves were supplemented once daily with either a soybean meal or a sunflower/feather meal supplement (44% CP, DM basis) at 1.5 lb/hd (DM basis). Although this supplementation regime was another factor in the trial, no statistical differences were found based on protein supplementation and data were pooled across supplements.

Results

Calves grazing corn residue gained more weight ($P = .003$) than those on soybean stubble. However, calves wintered on soybean residue did maintain their initial weight over the 71 days of grazing and stayed healthy. Calves grazing cornstalks did not perform as well as in previous years; however, this is likely a function of a lesser amount of residual corn remaining in fields in the winter of 1996-1997 and a few weeks of cold weather. Average estimates place residual corn grain at 4.2% of the corn yield, and yields for 1996-97 averaged 138 bu/acre (as-is). In an average year, then, 5.8 bu/acre (as-is) of residual corn could be expected to remain in the fields after harvest, compared to the 0.58 bu/acre (as-is) actually found in 1996-97. Figure 1 illustrates a second order polynomial line fit to the average weekly calf weights on both corn and soybean residues throughout the trial. Based on the graph, it appears calves grazing soybean residue did not begin to deviate in weight from calves on cornstalks until the first of January. However, calves grazing corn residue can typically be expected to gain 1 lb/d; calves in this trial gained only 0.17 lb/d. Assuming the soybean residues in this particular year were of ‘average’ quality, calf gains must not be expected to be as similar for corn and soybean residues in most years as was experienced in the present trial.

Figure 2 shows the CP of both the corn and soybean diets selected by calves throughout the trial. A treatment x time interaction was detected ($P<.0001$), because the CP values for diets selected from bean residues initially declined compared to increases in corn residues. Differences between CP in corn and bean residues were noted from December 14 through December 22 ($P<.05$) as calves consuming bean residues were likely consuming beans remaining on the pods. This is supported by visual observations of both whole beans and pods found in the diet samples. However, no differences were found on

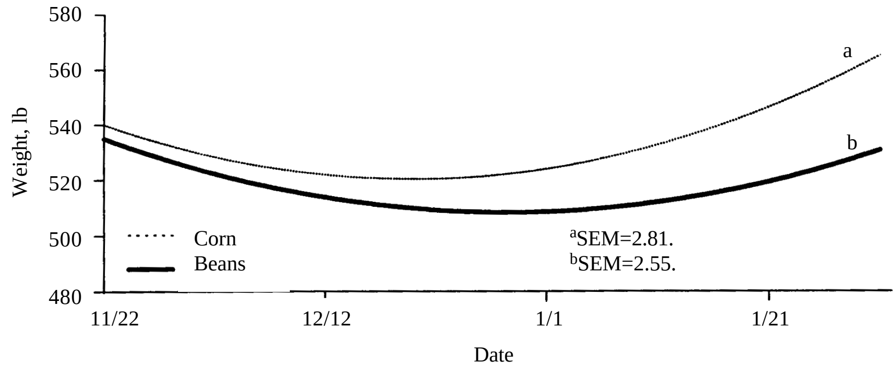

Figure 1. Weekly weights of calves grazing corn or soybean residues.

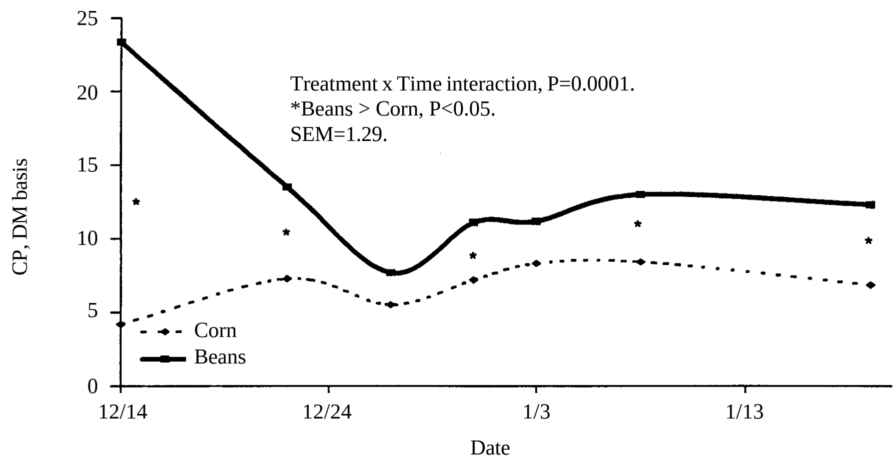

Figure 2. Crude protein of winter corn and soybean residues.

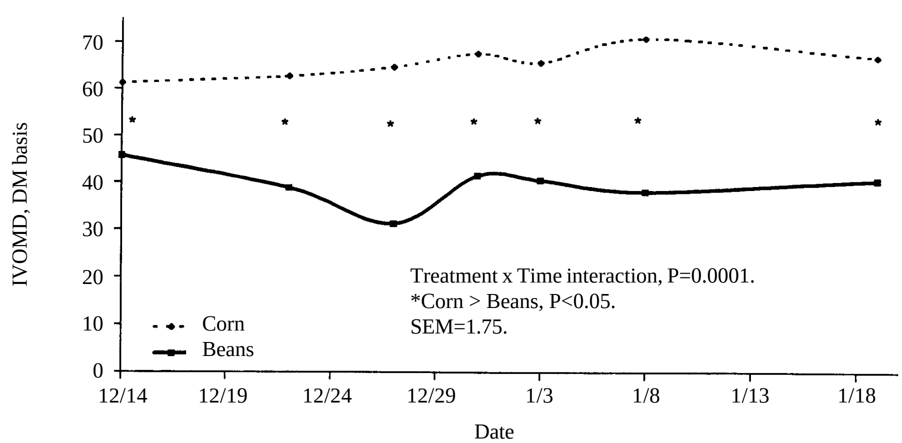

Figure 3. In vitro organic matter disappearance of winter corn and soybean residues.

December 27, as there was a light snow cover on the ground which would have inhibited selection of beans and pods. From that time, crude protein values were generally five units greater for bean residues compared to corn through the end of the trial.

Crude protein values increased (P<.05) initially from 4.2 to 7.3% CP (DM basis) for calves grazing corn residues. Diets from bean residues initially declined (from 23.4 to 7.7% CP, DM basis; P<.05) through December 27, then slightly increased (from 7.7 to 11.1% CP, DM basis; P<.05) through December 31, and remained constant through the end of the trial.

While the CP values of diets selected by calves consuming soybean residues were high, IVOMD values (Figure 3) were low. Analysis of IVOMD values showed a treatment x time interaction (P<.0001) as corn residues generally increased in IVOMD, while, in time, bean residues generally decreased in IVOMD. Corn residues were consistently greater (P<.05) in IVOMD compared to bean residues selected by fistulated steers throughout the trial. Variations in bean residue IVOMD values from December 22 through December 27 were likely due to a light snow cover.

In vitro organic matter digestibility values for bean residues (Figure 3) were lower than expected. Values this low would not be expected to support maintenance. Last year, IVOMD values for pods were 64% (DM basis; 1997 Nebraska Beef Cattle Report, pp. 26-27) and whole beans were highly digested. If the calves were consuming pods and beans early in the grazing period, IVOMD values should have been above 64%. The lower values observed in this trial may be due to consumption of leaves and stems, which are much lower in digestibility than pods. It is also possible that soybean fat was not accounted for in the IVOMD procedure and may have been measured as undigested. This would underestimate the digestibility values for the diets, and, because the fat is higher in energy than carbohydrates, would also underestimate the digestible energy content of the soybean residue diets.

Analysis of either corn or bean IVOMD values over time showed corn residue diets selected by fistulated steers varied throughout the trial, but generally remained constant over the first two weeks of the trial and then increased (from 64.6 to 67.6% IVOMD, DM basis; P<.05) from December 27-31, then remained constant until a decrease in the last two weeks of the trial (from 70.8 to 66.8% IVOMD, DM basis; P<.05). Other cornstalk grazing research has shown IVDMD values are roughly 60% (DM basis) after 40 days of grazing when residual corn has been consumed. Calves in this trial consumed relatively constant diets containing

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about 60-65% digestible organic matter (DM basis) and IVOMD values did not significantly decline until the last two weeks of the trial. This supports previous work which indicated residual corn estimations show a significant decline in IVDMD values 3-4 weeks into the grazing period, after residual corn has been consumed. Bean residue values initially declined (*P*<.05) from 45.7 down to 31.2% IVOMD (DM basis) in the first two weeks of the trial, then increased (*P*<.05) to 41.4% IVOMD (DM basis) from December 27-31, remaining constant through the end of the trial. Again, the decline in IVOMD around December 27 was likely due to snow cover during grazing. Without the December 27 collection, it is likely no time differences in terms of IVOMD would have been found for the bean stubble.

In this particular year, while calves grazing bean residue did maintain weight and health at a stocking rate of 2 acres/animal, still more acres (2.4) appear required to carry calves as long as calves grazing corn residue at a stocking rate of 0.8 acres/animal. In addition, calves grazing bean residue may be more limited by the digestible energy of the residue than available residue, based on IVOMD values obtained in the present trial.

The higher protein content of soybean residue would complement the lower protein-higher energy contents of the corn residue when both are grazed simultaneously. Therefore, it appears soybean residue has some value for both calves and cows. However, the energy value is lower and about three times as many acres would be needed in order to carry an animal on solely soybean residue compared to corn residue.

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[1]D. J. Jordon, graduate student; Terry Klopfenstein, Professor; Mark Klemesrud, research technician, Animal Science, Lincoln.